

**Instructions:** Put your name, PID, section number, and TA's name on your blue book. No calculators or electronic devices are allowed. Turn off and put away your cell phone. You may use one page of handwritten notes, but no other resources. Make sure your solutions are clear and legible. **Show all of your work.** Credit will not be given for unreadable or unsupported answers. Please keep the questions in order in your blue book and clearly indicate which problem is on which page.

1. (10 points)

- (a) (4 pts) Find the equation of the line that passes through the points  $(2, 5)$  and  $(-2, 7)$ . Express your answer in slope-intercept form ( $y = mx + b$ ).
- (b) (4 pts) Find a real number  $t$  such that the line passing through the points  $(t, t)$  and  $(2, 5)$  is perpendicular to the line  $y = -\frac{1}{3}x + 5$ .
- (c) (2 pts) Find an equation of the line which passes through the point  $(4, 3)$  and is perpendicular to the line  $y = 5$ .

2. (4 points)

- (a) Find a formula which gives the distance between the points  $(-t, 2t)$  and  $(3, 0)$  in terms of  $t$ .
- (b) Find the value of  $t$  which minimizes this distance (from part (a)).

3. (4 points) Find the domain of the function

$$f(x) = \frac{x^3}{|5x - 2| - 3}.$$

Express your answer using interval notation.

4. (8 points) Suppose you have a function  $f(x)$  whose domain is the interval  $[-2, 5]$  and whose range is the interval  $[2, 6]$ . Define a new function  $g(x)$  by the following sequence of transformations:

- i. Shift the graph of  $f$  vertically upwards by 3 units.
- ii. Stretch the graph from (i) vertically by a factor of  $\frac{1}{2}$ .
- iii. Stretch the graph from (ii) horizontally by a factor of  $\frac{1}{2}$ .

- (a) (4 pts) Find a formula for  $g$  in terms of  $f$ .
- (b) (2 pts) What is the domain of  $g$ ?
- (c) (2 pts) What is the range of  $g$ ?

5. (7 points) Define the function  $f(x) = \frac{2}{x-4}$ .

- (a) Find a formula for the inverse function  $f^{-1}$ .
- (b) State the domain and the range of  $f$ .
- (c) State the domain and the range of  $f^{-1}$ .

6. (4 points) Suppose  $f(x)$  is an odd function and  $g(x)$  is an even function which both have domain  $(-\infty, \infty)$ . (*You do not need to justify your answer on these problems*)

- (a) Is  $(g \circ f)(x)$  an even function, an odd function, or not necessarily either?
- (b) Is  $(f \circ f)(x)$  an even function, an odd function, or not necessarily either?

7. (3 points) Find a value of  $b$  such that  $-1$  is a zero of the polynomial

$$p(x) = 7 + 4x + 5x^2 + bx^3 + 2x^{81}.$$